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THE IMPACT OF LOAD CARRIAGE ON LOWER-BODY POWER IN SWAT POLICE

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INTRODUCTION

Special Weapons and Tactics (SWAT) police are required to carry occupational loads of approximately 20 kg and, on occasion, more than 40 kg.

- **Personal protective equipment,**
- **Ballistic shield,**
- **Breaching equipment,**
- **Assault weapon,**
- **Police baton,**
- **Cuffs,**
- **Knife,**
- **Radio,**
- **Flashlight**





INTRODUCTION

These loads have an positive role

and

Negative role,

- **Protecting the body,**
- **Sustaining and enhancing operational capabilities.**

- **Physical performance of tactical personnel,**
- **Load can lead to a variety of injuries.**

Mobility (Orr et al., 2019) and jumping performance (Dempsey et al., 2014) were found to be hindered by occupational load.

In addition, change of direction speed while carrying the load was found to be associated with jumping performance of police officers (Orr et al., 2019).

However, the impact of a full tactical load on the leg power of SWAT officers has not yet been investigated.

The purpose of this study was to investigate the effects of the standard tactical load worn by SWAT police on their leg power performance.

- Dempsey, P. C., Handcock, P. J., & Rehrer, N. J. (2014). Body armour: the effect of load, exercise and distraction on landing forces. *J Sports Sci*, 32(4), 301-306.
- Orr, R., Kukić, F., Cvorovic, A., Koropanovski, N., Janković, R., Dawes, J., & Lockie, R. (2019). Associations between Fitness Measures and Change of Direction Speeds with and without Occupational Loads in Female Police Officers. *Int J Environ Res Public Health*, 16(1947).



METHODS

Participants

Six (n = 6) active male officers of a state SWAT police unit were selected.

- **Age = 34.0 ± 7.4 years**
- **Height = 184.2 ± 3.3 cm,**
- **Body mass = 96.3 ± 6.4 kg,**
- **Years of specialist experience = 6.0 ± 6.8 years.**

Inclusion criteria for participation were

- **Members of the specialist unit,**
- **Over 18 years of age.**

Exclusion criterion for participation was

- **Any officer who had an injury at the time of data collection.**

Load conditions

Unloaded (approx. 5.5 kg)

- **Police clothes (fatigues and boots),**
- **M4 carbine assault rifle (primary weapon),**
- **9mm Glock pistol (secondary weapon).**

Loaded (approx. 23.5 kg - about 24.5% of body weight)

- **Unloaded condition,**
- **Body armour,**
- **Helmet.**



METHODS

Leg power assessment

Repeated vertical jump test using a uni-axial portable force plate*.

- **Participants performed 3 consecutive maximal counter movement jumps, with hands on their hips.**
- **They were allowed to perform the test twice – better result was recorded.**
- **Rest was 3 min. between attempts and 10 min. between load conditions.**
- **The order in which the subjects performed test (i.e. unloaded or loaded) was randomised (ballot lot draw).**

Vertical jump variables assessed included

- **Peak velocity (m/s),**
- **Peak force (N),**
- **Peak power (N/s),**
- **Jump height (m),**
- **Landing impact force (N).**

Statistical analysis

- **Paired sample t-test ($p < 0.05$),**
- **Cohen's effect size (d) – small = 0.5, medium = 0.8, large = 1.3,**
- **Pearson's correlation ($p < 0.05$).**

*400 Series Performance Force Plate; Fitness Technology, Adelaide, Australia



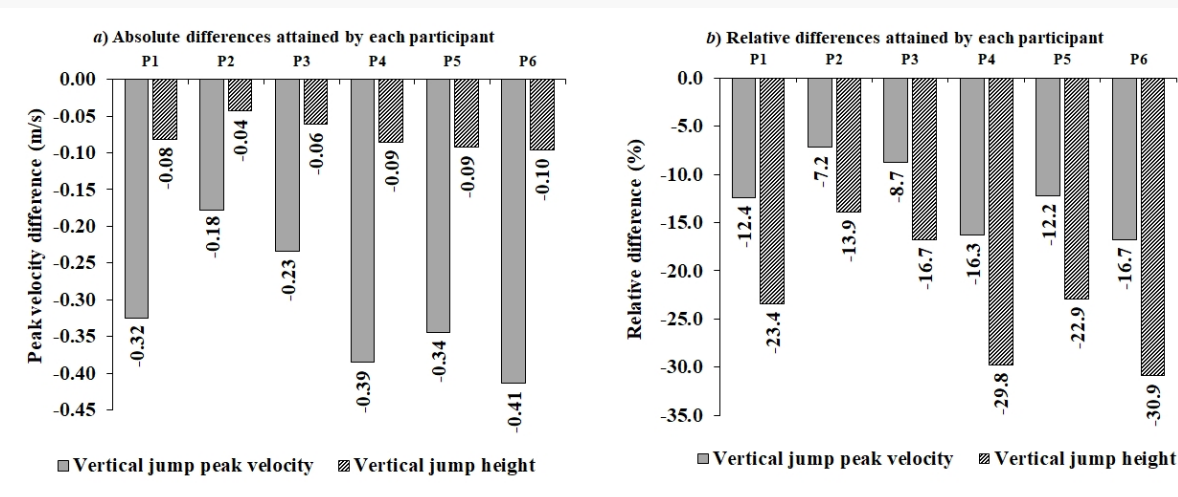
RESULTS

Table 1. The influence of loading on average of repeated vertical jump performance.

Variables	Unloaded	Loaded	Difference
	Mean ± SEM	Mean ± SEM	Mean ± SEM
Vertical jump peak velocity (m/s)	2.57 ± 0.07	2.26 ± 0.08	-0.31 ± 0.04**
Vertical jump peak force (N)	2369.42 ± 114.20	2491.21 ± 74.07	121.79 ± 67.20
Vertical jump peak power (N/s)	4641.15 ± 239.97	4488.26 ± 276.86	-152.89 ± 93.00
Vertical jump height (m)	0.34 ± 0.02	0.26 ± 0.02	-0.08 ± 0.01**
Vertical jump landing force (N)	3169.53 ± 143.38	3180.38 ± 108.23	10.85 ± 133.71

****Significant at $p < .001$.**

Figure 1. Absolute (a) and relative (b) differences in vertical peak velocity and vertical jump height for each participant.

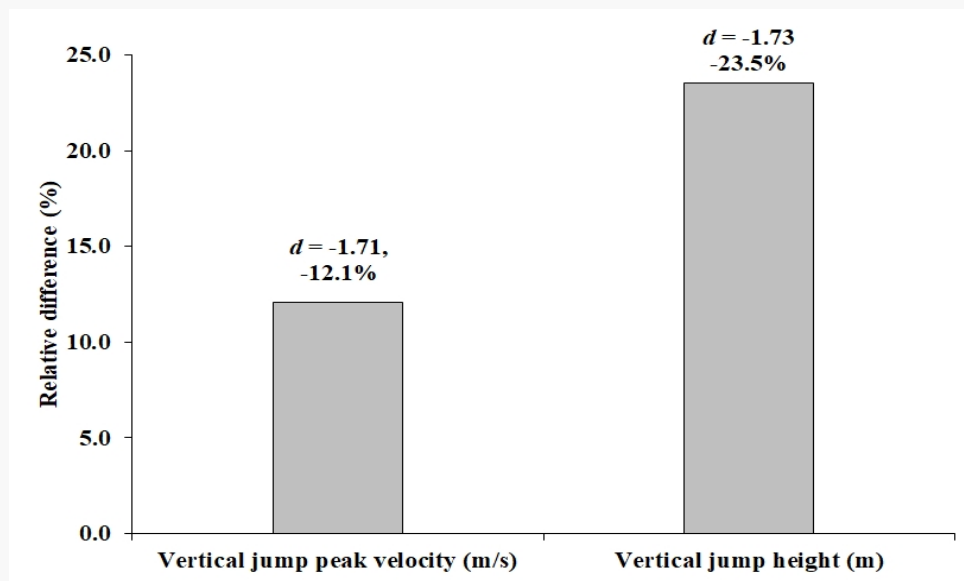


- The average vertical jump peak velocity was significantly lower (-0.31 ± 0.04 m/s, $-8.48(5) = 2.57$, $p < .001$) in the loaded condition.
- Average vertical jump height was also significantly reduced (-0.08 ± 0.01 m, $-9.20(5) = 2.57$ $p < .001$) in the loaded condition.
- These negative effects of the load occurred for each participant, with larger relative differences in jump height than jump peak velocity.



RESULTS

Figure 2. Cohen’s effect size (d) and relative (%) difference between the unloaded and loaded conditions.



The relative impact of the load was greater on the vertical jump height than on the vertical jump peak velocity.

Table 2. Correlations between the unloaded and loaded performance of the repeated vertical jump.

Variables	r value	p value
Vertical jump peak velocity (m/s)	.90	.02
Vertical jump peak force (N)	.83	.04
Vertical jump peak power (N/s)	.95	.004
Vertical jump height (m)	.90	.02
Vertical jump landing force (N)	.46	.35

No significant correlation was found only between the unloaded and loaded vertical jump impact forces.

- SWAT officers performed the initial vertical jump height and the final third jump equally effective, in both the unloaded and loaded conditions.
- The jump height of the initial vertical jump under loaded conditions correlated significantly with the performance of the final third vertical jump ($r = 0.99$, $p < .001$).
- No significant correlation was found in the unloaded condition between the first and third vertical jump heights ($r = 0.63$, $p = .18$).



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CONCLUSION

- **Lower-body power in SWAT Officers is reduced during load carriage.**
- **This can potentially lead to decreased tactical performance in critical tasks, such as seeking, or moving between, cover, jumping and landing.**
- **Officers should train to increase lower-body power in both unloaded and loaded conditions to mitigate this impact.**
- **This is of importance as good capability in landing, deceleration and stopping while carrying loads may reduce the risk of injury.**



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QUESTIONS

???

Thank you!!!



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